REMARKS/ARGUMENTS

Claims 1, 4, 5, 7-10, 12-19, and 21-24 are in the application.

Claims 21 and 22 have been rejected under 35 U.S.C. § 102(b) as anticipated by Immarco. Claims 1, 4, 5, 7, 9, 10, 12, 15, 16-19, 23 and 24 have been rejected under 35 U.S.C. § 103 as obvious over Xie in view of Immarco. Claims 8 has been rejected under 35 U.S.C. § 103 as obvious over Xie in view of Immarco and Motohiro. Claims 13 and 14 have been rejected under 35 U.S.C. § 103 as obvious over Xie in view of Immarco and Friesem. The rejections are respectfully traversed for the following reasons.

Claims 21 and 22 are readily distinguishable from Immarco. Immarco defines a Q-switched laser including an electro-optical modulator and a birefringent polarizing prism. The Brewster angle prism made of birefringent material is the polarizer of the laser cavity. This means that Immarco is operating the laser in an electro-optical Q-switch by means of an electro-optical modulator 16 (Fig.1) and one polarizer 15 (Fig.1) or two polarizers 40 (Fig. 6) as known in the prior art.

Although the prism polarizer described by Immarco has the mechanical shape of a wedge, it is not an optical wedge. An optical wedge is characterized by a window with non-parallel faces which are separated by a small angle such that the beam propagating through the wedge is slightly diverted but always transmitted by both faces. The angle of an optical wedge is typically in the range of 0.1 to 1 degree.

The present invention requires that the wedge birefringent optical element have a wedge angle small enough to transmit light through both faces with no loss, irrespective of the polarization state. The prism disclosed by Immarco is a true a polarizer wherein the second face transmits one polarization and reflects an orthogonal polarization. If a polarizing prism were to be inserted in Applicants' cavity, there would be no freedom to choose the desired lasing polarization.

For the preceding reasons reconsideration and withdrawal of the rejection of claims 21 and 22 as anticipated by Immarco is believed appropriate.

As to the rejection of claim 8, the wedge active element, as recited in claim 8, is not present in Immarco. The active element of the electro-optical modulator in Immarco is a parallel faces crystal 16 (Fig. 1) and is not equivalent to the birefringent polarizing prism 15 (Fig. 1).

The rejection of claim 8, and of the remaining claims, also relies on the teaching of Xie. Xie is inapposite for the following reasons.

Applicant's invention relates to a cavity operated in Q-switching or mode-locking regime, i.e. it employs techniques which generate pulses of very high intensity and very short duration. Xie discloses a single mode laser (see title and col. 1, lines 5-11). A single mode laser operates in only one longitudinal mode (single frequency) with a continuous wave.

In accordance with Fourier theory, reducing the frequency spectrum of an electromagnetic wave results in enlarging the period and reducing the peak amplitude of the wave. By operating a laser cavity in order to reduce the number of wavelengths oscillating inside it, Xie teaches increasing the width and reducing the amplitude of the laser pulse. That is, Xie teaches away from operating a laser in Q-switching with the shortest possible pulse or highest peak intensity. As a consequence one skilled in the art of laser systems would not look to Xie in order to operate a laser cavity in Q-switching or mode-locking.

In order to modulating cavity losses for preventing laser oscillation, Immarco makes use of a Pockels cell in combination with one or two polarizers. As disclosed in the instant application at page 2 line 17 - page 3, line 6, polarizers cannot be easily utilized in laser systems with high average power due to high intrinsic losses and a limited optical damage threshold.

The instant invention provides a method for modulating the cavity losses in a laser operated in Q-switching which does not require a polarizer as recited in the preamble to claim 1. The invention provides several advantages in a laser operated in Q-switching or mode-locking.

Firstly, it allows an improved loss modulation since, by applying a voltage to the electro-optical modulator, it is possible to completely switch off the only polarization that would be allowed to oscillate in the laser cavity. This effect cannot be

achieved with polarizers which are transparent for one polarization but do not completely cut off other existing polarizations. (A small percentage of the unwanted polarization can pass through the polarizer and oscillate provided that laser gain is high enough.)

Secondly, it is extremely difficult, if not impossible, to manufacture polarizers with a high extinction grade for the polarization to be suppressed, inconsequential losses for the transmitted polarization, and a high resistance to optical damage. A birefringent wedge is easily manufactured and highly reliable.

Finally, polarizers require a lot of space in a laser cavity. A birefringent wedge allows for reducing the laser cavity dimensions and consequently the round trip time. Since the pulse duration is proportional to round trip time, it follows that the use of a birefringent wedge (which can be realized in one of the other components of the cavity) allows for shorter pulses with higher peak intensities.

Each of the cited prior art documents relating to Q-SWITCHing or mode locking operated lasers discloses the use of a polarizer in combination with a modulator in order to modulate the cavity losses. No prior art reference discloses

> ". . . [a] birefringent optical medium . . . used for inducing a double refraction effect on the laser beam and, on the interface between said birefringent optical medium and a second medium with a different refractive index, separating propagation directions of different polarization components of the laser beam, providing a plurality of resonance directions which are distinct for the different polarization components, and wherein

> an optical axis of the cavity is selectively aligned on one of said resonance directions through the adjustment of the position of one or more optical elements forming said resonant laser cavity so as to modulate the loss state of the resonant laser cavity in cooperation with the electro-optical modulator."

Nor would the cited references, whether considered individually or in combination, lead one skilled in the art to achieve loss modulation as claimed by Applicants. As shown above, Xie completely teaches away from Applicants' Q-switching techniques.

Moreover, one skilled in the art would not look to Xie for solving the technical problem for which Applicants' invention provides a solution for the reason that Xie is directed to a method for selecting a frequency, not to a method for effectively modulating the cavity losses in a Q-switching laser system.

For the preceding reasons reconsideration and withdrawal of the rejection of claims 1, 4, 5, 7-10, 12-19, 23 and 24 is believed appropriate.

The prior art cited but not applied in the rejection is believed to be inapposite to the claims.

In view of the foregoing, it is respectfully submitted that the application is now in condition for allowance. Early and favorable action is earnestly solicited.

An unpaid fee required to keep this case alive may be charged to deposit account 06-0735.

Respectfully Submitted,

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